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What is claimed is:

1. A semiconductor device comprising:

a protective insulating film deposited on a semiconductor substrate having first and second field-effect transistors formed thereon;

a capacitor composed of a capacitor lower electrode, a capacitor insulating film made of an insulating metal oxide, and a capacitor upper electrode which are formed in upwardly stacked relationship on the protective insulating film,

wherein an edge portion of the capacitor upper electrode is formed onto the protective insulating film;

a first contact plug formed in the protective insulating film to provide a direct connection between an impurity diffusion layer serving as a source or drain region of the first field-effect transistor and the capacitor lower electrode;

a second contact plug formed in the protective insulating film to provide a direct connection between an impurity diffusion layer serving as a source or drain region of the second field-effect transistor and the edge portion of the capacitor upper electrode; and

a hydrogen barrier film entirely covering the capacitor upper electrode.

2. The semiconductor device of claim 1, wherein the capacitor insulating film is formed conformally to the capacitor lower electrode, the semiconductor device further comprising:

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insulating sidewalls formed on respective side surfaces of the capacitor lower electrode and the capacitor insulating film, wherein

the capacitor upper electrode is formed over the capacitor insulating film and the sidewalls.

3. The semiconductor device of claim 2, wherein the sidewalls are made of silicon oxide.

4. The semiconductor device of claim 1, wherein the capacitor lower electrode includes a plurality of capacitor lower electrodes formed on the protective insulating film, the semiconductor device further comprising:

an insulating film formed between the plurality of capacitor lower electrodes, wherein

the capacitor insulating film is formed over the plurality of capacitor lower electrodes and the insulating film.

5. The semiconductor device of claim 4, wherein the insulating film is composed of silicon oxide.

6. The semiconductor device of claim 1, wherein each of the first and second contact plugs is made of polysilicon or tungsten.

7. The semiconductor device of claim 1, wherein the capacitor insulating film is made of a ferroelectric material having a bismuth layered perovskite structure, lead zirconate titanate, barium strontium titanate, or tantalum pentaoxide.

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